SECRET

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May 19, 1966

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[redacted]

Dear Sir:

Enclosed please find three (3) copies of our Sixth Monthly Letter Report on Evaluation (U), for the period covering 15 April 1966 to 18 May 1966, dated 18 May 1966. This report is being submitted under subject contract.

Sincerely yours,

[redacted]

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BJT:mvh
Encl.

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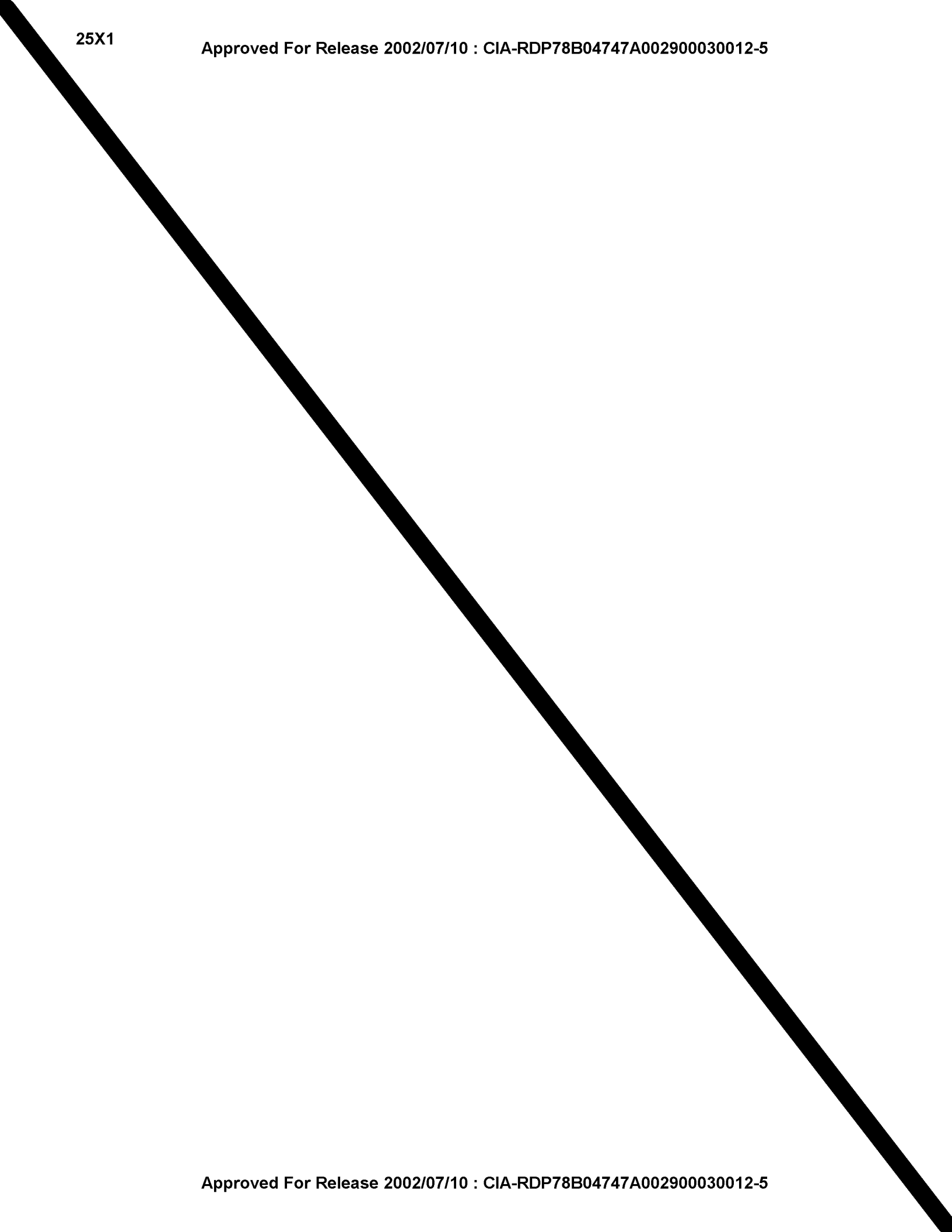

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SIXTH MONTHLY LETTER REPORT ON EVALUATION

1. Work for Reporting Period

During this past work period we have made measurements to determine the incoherent modulation transfer function of the enlarger system. This was done to determine how close to diffraction limited the lenses are. The following procedure was used. Using a precision edge of 3.5:1 contrast as the object, and moving a piece of finely ground glass directly in front of the object to reduce the ratio of coherence interval to lens spot size to approximately one, images were obtained. This was done for both the He-Ne laser source and the Na source. The edge image was then traced on the microdensitometer and the trace data used in the computer program. Figure 1 shows the results for the laser source and Figure 2 for the sodium source.

This procedure was then repeated with the object plane slightly shifted from the plane of best focus. This was done to determine exactly how critical the focussing is in terms of its effect on the incoherent modulation transfer function. Results show that for object plane shifts of ±0.0005" there is a negligible change in the transfer function while for a shift of ±0.001" (Fig. 1) there is a small but not negligible loss of modulation over the spatial frequency passband. These object plane shifts correspond to ±0.008" and ±0.016" shifts in the image plane, respectively, since the depth of focus increases as the square of the magnification.

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We have recently obtained experimental results showing the shape of edge images for partially coherent illumination. These are now being evaluated and compared directly with the images predicted on the basis of computer calculations.

The computer calculations of the expected images of [redacted] "L" targets have been obtained and the experimental images show qualitative agreement with these calculated images. Quantitative differences do exist, however, and it is felt that this is due to the restricted number of sampling points available in the computer program. As more points become available the interaction of each three bar group with the adjacent groups can be taken into account and a better approximation to the actual partially coherent imaging situation can be obtained. Work is now continuing on this extension of the computer program.

25X1

The theoretical results obtained for low contrast objects were mentioned in the last letter report. Since then we have also shown theoretically that when the amplitude transmittance of the object is locally constant over distances on the order of the coherence interval a partially coherent imaging system becomes linear in intensity. We are now investigating the implications of this result for this evaluation program.

2. Work for next period

During the coming month we will examine the spatial filtering capabilities of the enlarger.

3. Visits to the Contractor

None

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4. Changes in Personnel

None

5. Progress of Work

As of this reporting date, approximately 45% of the contract funds have been expended and 55% of the work program has been completed.

FIGURE 1

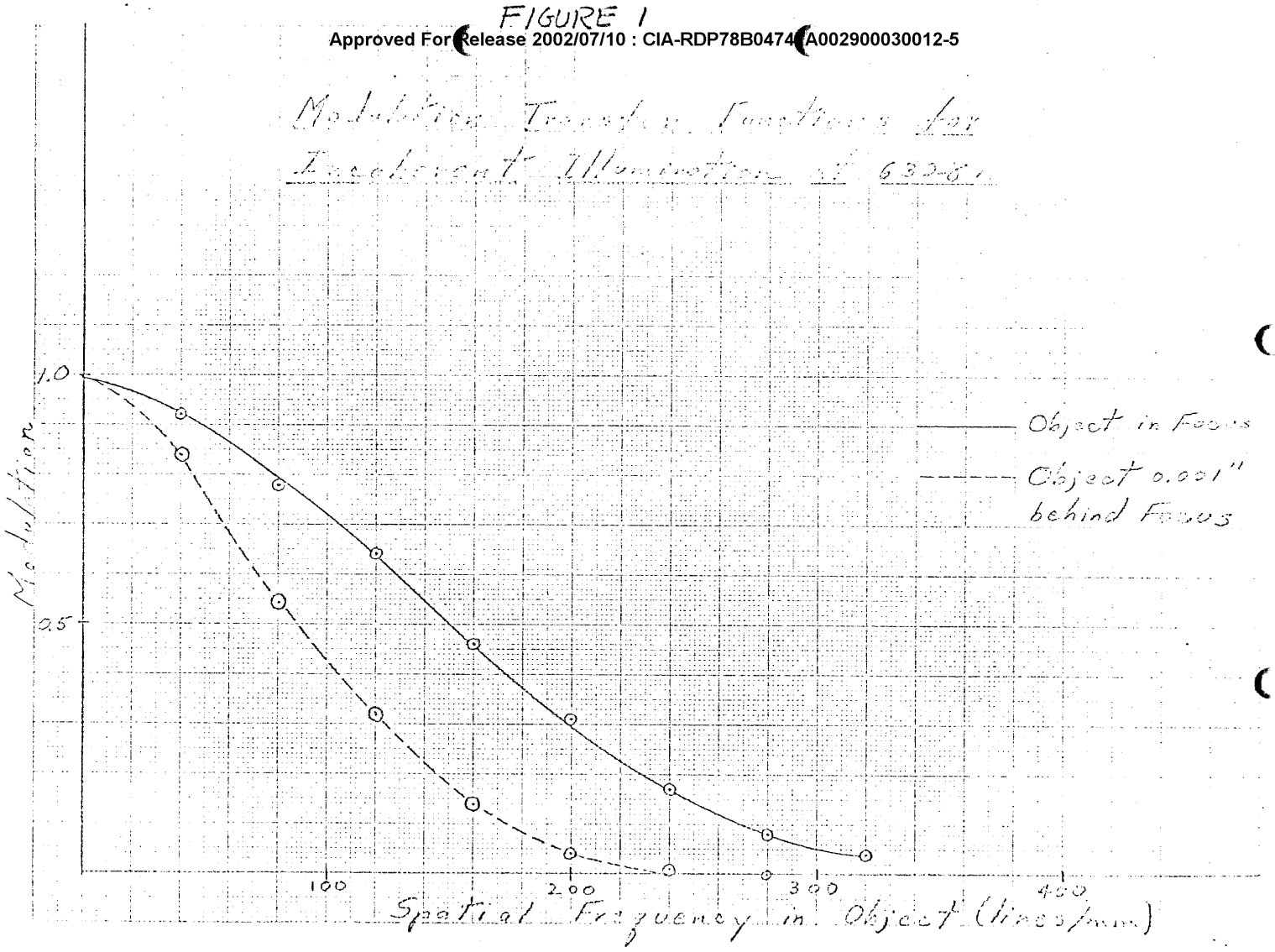

FIGURE 2